

**REMARKS**

Pursuant to the present amendment, claims 75, 76, 86 and 87 have been canceled and claims 36, 43, 77, 82, 88 and 92 have been amended. Thus, claims 36-46, 77-85 and 88-95 are pending in the present application. No new matter has been introduced by way of the present amendment. Reconsideration of the application is respectfully requested.

As an initial matter, the Examiner objected to Figures 1A-1B because they did not include the "Prior Art" legend. Submitted herewith are corrected drawings including the requested legend. Withdrawal of the objection is respectfully requested.

The Examiner objected to the title of the invention as allegedly being non-descriptive. Applicants hereby submit that the application title should be changed to read as follows: "METHOD OF REDUCING OXIDATION OF METAL STRUCTURES BY SELECTIVELY IMPLANTING IONS THROUGH A MASK POSITIONED ABOVE AND NOT IN CONTACT WITH THE SUBSTRATE" Withdrawal of the objection to the title is respectfully requested.

In the Office Action, claims 36-46 and 77-85 were rejected under 35 U.S.C. § 102 as allegedly being anticipated by Andricacos (U.S. Patent No. 6,268,291). Claims 75-76 and 86-87 were rejected under 35 U.S.C. § 103 as allegedly being unpatentable over Andricacos in view of Campi (U.S. Patent Publication No. 2003/0022072). Claims 88-95 were rejected under 35 U.S.C. § 103 as allegedly being unpatentable over Liu (U.S. Patent No. 6,500,749) in view of Campi and Andricacos. Applicant respectfully traverses the Examiner's rejections.

As the Examiner well knows, an anticipating reference by definition must disclose every limitation of the rejected claim in the same relationship to one another as set forth in the claim. *In re Bond*, 15 U.S.P.Q.2d 1566, 1567 (Fed. Cir. 1990). To the extent the Examiner relies on principles of inherency in making the anticipation rejections in the Office Action, inherency

requires that the asserted proposition necessarily flow from the disclosure. *In re Oelrich*, 212 U.S.P.Q. 323, 326 (C.C.P.A. 1981); *Ex parte Levy*, 17 U.S.P.Q.2d 1461, 1463-64 (Bd. Pat. App. & Int. 1990); *Ex parte Skinner*, 2 U.S.P.Q.2d 1788, 1789 (Bd. Pat. App. & Int. 1987); *In re King*, 231 U.S.P.Q. 136, 138 (Fed. Cir. 1986). It is not enough that a reference could have, should have, or would have been used as the claimed invention. “The mere fact that a certain thing may result from a given set of circumstances is not sufficient.” *Oelrich*, at 326, quoting *Hansgirg v. Kemmer*, 40 U.S.P.Q. 665, 667 (C.C.P.A. 1939); *In re Rijckaert*, 28 U.S.P.Q.2d 1955, 1957 (Fed. Cir. 1993), quoting *Oelrich*, at 326; see also *Skinner*, at 1789. “Inherency ... may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.” *Skinner*, at 1789, citing *Oelrich*. Where anticipation is found through inherency, the Office’s burden of establishing *prima facie* anticipation includes the burden of providing “...some evidence or scientific reasoning to establish the reasonableness of the examiner’s belief that the functional limitation is an inherent characteristic of the prior art.” *Skinner* at 1789.

Moreover, to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant’s disclosure. *In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991); M.P.E.P. § 2142. Moreover, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490

F.2d 981, 180 U.S.P.Q. 580 (CCPA 1974). If an independent claim is nonobvious under 35 U.S.C. § 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988); M.P.E.P. § 2143.03.

With respect to alleged obviousness, there must be something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination. *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561 (Fed. Cir. 1986). In fact, the absence of a suggestion to combine is dispositive in an obviousness determination. *Gambro Lundia AB v. Baxter Healthcare Corp.*, 110 F.3d 1573 (Fed. Cir. 1997). The mere fact that the prior art can be combined or modified does not make the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 U.S.P.Q.2d 1430 (Fed. Cir. 1990); M.P.E.P. § 2143.01. The consistent criterion for determining obviousness is whether the prior art would have suggested to one of ordinary skill in the art that the process should be carried out and would have a reasonable likelihood of success, viewed in the light of the prior art. Both the suggestion and the expectation of success must be founded in the prior art, not in the Applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991; *In re O'Farrell*, 853 F.2d 894 (Fed. Cir. 1988); M.P.E.P. § 2142.

Pursuant to the present amendment, independent claims 36, 77 and 88 have been amended to recite that the ion implant process is performed by selectively implanting ions through a mask that is positioned above and not in contact with any material formed above the substrate. Of course, the Examiner will need to consult each of the amended claims to confirm the exact claim language and any other additional changes made to the claims. Support for the amendments is set forth in the application in Figure 3A and the associated discussion within the

specification. As thus amended, it is respectfully submitted that all pending claims are in condition for immediate allowance.

By way of background, one illustrative invention disclosed in the patent application is directed to the selective implantation of dopant material into conductive metal structures. In one embodiment, this selective doping is accomplished by using a stencil mask lithographic ion implant (SLIM) tool developed by ULVAC of Japan. Specification, pp. 10-11. Use of the tool, as schematically depicted in Figure 3A, involves implanting ions through a stencil mask 44 that is positioned above and not in contact with any material formed on the semiconducting substrate. In general, the methodology depicted in the present application is intended to replace traditional photolithography processes that involve, among other things, formation of a resist layer, exposure of the resist layer in a stepper exposure tool, development of the exposed resist layer, stripping of the resist layer and cleaning of the wafer after the removal of the resist layer. Using the present methodology, dopant ions may be selectively implanted into desired areas without the need for the traditional photolithography process steps outlined above.

As thus amended, it is respectfully submitted that all pending claims are in condition for immediate allowance. The Examiner's primary reference, Andricacos, certainly does not disclose nor suggest the methodology set forth in the various independent claims now pending in the present application. Andricacos discloses three techniques whereby impurities may be added to a copper structure. A first method involves formation of a copper seed layer followed by implanting the seed layer with a desired dopant material. In another technique, the copper seed layer is formed and a layer of material containing the impurities is electro-deposited onto the seed layer. Thereafter, an anneal process is performed such that the impurities can diffuse into the copper seed layer. Lastly, Andricacos discloses the formation of a barrier layer followed by

performing an implant process to implant dopant material into the barrier layer, followed by the deposition of a copper seed layer and a subsequent anneal process. Col. 9, l. 41 – Col. 10, l. 39. At no point does Andricacos disclose or suggest the methodology whereby ions are selectively implanted through a mask that is positioned above and not in contact with any material layer formed above the substrate into a conductive metal structure.

The Campi reference is understood to be directed to a method of forming photomasks used in semiconductor chip manufacturing. ¶ 1. It is clear that Campi is directed to photomasks employed in optical photolithography tools, *e.g.*, steppers, wherein light is projected through a photomask onto a wafer. Campi notes that one technique for controlling light diffraction at the boundary between opaque and transparent portions of the photomask is phase-shift photolithography. ¶ 5. Campi further notes that another problem faced with present photomasks is the mask error factor. ¶ 6. According to Campi, what is needed is a physically stronger mask than those that are presently available that has better resolution, reduced mask error factors and greater flexibility with regard to the use of phase-shift transmission.

Campi is generally directed to a binary photomask that comprises an energy transparent substrate 100 that is coated with a layer of energy-blocking material 110. ¶ 67. In turn, the energy-blocking material 110 is coated with a negative layer of photoresist. Thereafter, the photoresist layer is developed using standard techniques to selectively remove photoresist in unexposed regions 120 thereby leaving exposed regions 130 of the photoresist intact. Figure 3A, ¶ 67. The binary mask is then bombarded with high energy ions to convert the residual photoresist 130 to a diamond-like carbon (DLC) material. The energy blocking material 110 that is not covered by this DLC material is removed to result in a photomask 180. ¶ 67; Figure 3D.

In short, Campi is directed to the methods of forming a binary photomask that will be used in traditional optical photolithography equipment, *e.g.*, a stepper tool.

As thus understood, it is respectfully submitted that Campi does not disclose nor suggest a method of performing an ion implant process through a mask positioned above and not in contact with the substrate or any material formed thereon to selectively implant dopant material into a conductive structure.

Liu is also believed to be far afield from the present invention. As shown therein, Liu discloses the formation of a traditional photoresist mask 32 and the subsequent implantation of ions through the mask opening 34. Figure 2, Col. 2, ll. 55-67. Again, at no point does Liu disclose or suggest the step wherein dopant materials are selectively implanted into a conductive structure through a mask positioned above and not in contact with any material layer formed on the substrate.

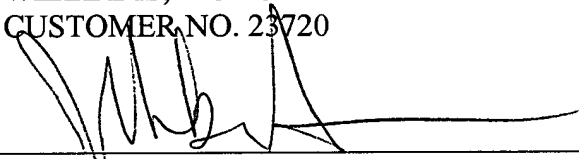
It is respectfully submitted that any attempt to assert that the invention set forth in the currently pending claims, as amended, is obvious in view of the prior art of record would constitute an improper use of hindsight using Applicant's disclosure as a roadmap. As set forth above, at no point does any of the references considered individually or in combination disclose or suggest the step selectively of implanting ions into a conductive structure through a mask positioned above and not in contact with any material layer formed on the substrate. If anything, some of the prior art cited by the Examiner, can be said to teach away from the present invention. For example, Liu discloses the formation of a traditional photomask layer 32 that is patterned to define an opening through which dopant materials are thereafter implanted.

In the Office Action, the Examiner issued a double patenting rejection in view of U.S. Patent No. 6,703,309. Submitted herewith is a Terminal Disclaimer that obviates the Examiner's double patenting rejection.

In view of the foregoing, it is respectfully submitted that all pending claims are in condition for immediate allowance. The Examiner is invited to contact the undersigned attorney at (713) 934-4055 with any questions, comments or suggestions relating to the referenced patent application.

Respectfully submitted,

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